IDRC-190e

Computer-Based Conferencing Systems for Developing Countries

Report of a workshop held in Ottawa, Canada, 26-30 October 1981

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are in Ottawa, Canada. Regional offices are located in Africa, Asia, Latin America, and the Middle East.

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Report of a workshop held in Ottawa, Canada, 26–30 October 1981

Compiled and edited by David Balson, Robert Drysdale, and Bob Stanley

Organized by the International Development Research Centre in cooperation with the International Federation for Information Processing

Contents

Foreword

Recent technologies, particularly low-cost high-speed digital telecommunications, are promising to eliminate distance as a barrier to interpersonal communication, both on a one-to-one basis and within groups. Computer-based conferencing is a new development that appears to offer particular advantages for meeting certain of the objectives of the International Development Research Centre (IDRC): encouraging the coordination of international development research and fostering cooperation in research on development problems.

Clearly, the lack of effective communication systems is an impediment to research cooperation in many countries of the Third World. The process of building a traditional communications infrastructure is slow and expensive. A way to supplement this process is urgently needed to enable scientists within a developing country to communicate with each other and with their colleagues in other countries, both industrialized and developing.

Computer-based conferencing is increasingly used within industrialized countries and by large multinational corporations to coordinate activities at home and around the world. It is an effective tool in that it not only helps to cross language barriers and eliminate time differences, but also substitutes communication costs for travel costs for a considerable potential saving.

As these systems become utilized more and more in the industrialized world, there is a fear that the Third World will be left out when new networks are designed and will lose the opportunity for early participation. With the reduced cost of computer hardware making equipment more accessible, it seemed timely to examine this new communication medium, particularly with regard to its potential for improving scientific communications in the Third World.

To explore the state of the art and receive advice from experts in the field, IDRC convened a workshop in Ottawa, Canada, from 26–30 October 1981, to discuss the opportunities and pitfalls that computer-based conferencing offers to developing countries, as well as to look at its technical feasibility. In this regard, answers were sought to the following questions: Is computer-based conferencing now viable for use in developing countries, or between them and the more developed countries? If so, are formal structures necessary to ensure that developing countries are involved in the design and implementation of worldwide computer-based conferencing programs? What role, if any, is there for IDRC to play in making this new medium of communication available to developing countries? What are the technical, legal, and organizational implications of such implementations?

The need for such a workshop was revealed by the fact that although IDRC received many expressions of interest from industrialized countries it was able to identify only two individuals with knowledge of the subject to invite from the developing countries; the remaining 12 participants were, in fact, drawn from industrialized countries and international organizations. Five days of intensive,

often exciting, discussions culminated in a series of recommendations for action that can be found in the concluding portion of this report.

The report also includes a brief summary of presentations by the participants and the discussions that ensued. In its brevity, it cannot entirely do justice to the importance of the contributions made by each participant. Coming together for only a few days from a variety of backgrounds and cultures, they, nevertheless, were able to work together as a team in developing proposals and preparing the recommendations. Their contributions will be invaluable to the Information Sciences Division of IDRC in formulating its future programs. It is also my belief that this is, in a sense, a preliminary report and that, for the workshop participants, it marks the beginning of an association rather than the end.

In parallel with this workshop, and extending over a period of several weeks before and after the event, a public computer conference, which attracted many participants from North America and Europe, took place on the Electronic Information Exchange System (EIES). Reports from the "live" workshop were fed daily into the EIES conference, and responses were distributed to the workshop participants. A summary of this computer conference can be found in Appendix I. The participation of all who took part in this experiment is greatly appreciated and, in the same spirit of seeking advice and information, comments from readers of this summary report on the ideas and recommendations it contains would be well received.

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Introduction

The complexity and diversity of national and international information exchange has increased greatly during the present century. At the same time, since the advent of the computer, rapid advances have been made in the field of communications. One of these advances may contribute significantly to the demand for new, effective, and efficient mediums of communication: computer-based conferencing systems (CBCSs).

Many names have been used to describe this new medium of communication: computer conferencing, computer-based messaging, computer-mediated interaction, electronic mail, teleconferencing, etc. It was the collective decision of the participants in this workshop to call the systems that employ these techniques computer-based conferencing systems.

These systems are designed to facilitate communication among any number of geographically dispersed individuals and communities by using the storage, retrieval, and processing capabilities of the computer. In comparison with face-to-face communication, a CBCS allows individuals to communicate by typing into and reading from computer terminals rather than speaking and listening to each other.

Most CBCSs, at present, are based on three main facilities. First, all systems have some type of text-editing facility. Second, by using the text-editing facility, a "message" or "letter" can be composed and addressed to one or more individuals. The computer stores and then forwards these communications when requested by the addressee. Third, these messages or letters may take the form of "conference comments" or "conference entries," entered in what is called a "computer conference." These conferences are usually topic-oriented discussions with varying degrees of structure into which participants may add comments and are able to read any new entries entered since the last time they signed onto the conference. In effect, a dynamic data base is created.

Various other facilities are also provided by these systems. Keywords can be assigned to messages and comments when entered, thus allowing easy retrieval of information pertaining to desired subjects. Similarly, messages can be linked to previously entered messages, allowing one to trace a sequence of entries backward in time. A voting facility is provided in some systems. Larger, personal work spaces are available in some systems, permitting composing, storing, and revising of material for joint authorship of papers or for storing larger bodies of text that may be referenced and then read by other participants in the system. Most CBCSs have both a relatively simple operating protocol for new users and a more advanced protocol for experienced users.

The earliest use of this technology occurred in the 1950s, when programers used the computer to exchange comments as an aid to developing and altering programs. In the 1960s, several groups explored the use of computer conferencing to streamline the Delphi process. In the early 1970s, the Emergency Man-

agement Information System and Reference Index (EMISARI) was designed and implemented by the U.S. Office of Emergency Preparedness (OEP) to deal with various governmental regulatory problems such as wage and price controls. It was later used by the U.S. Federal Preparedness Agency to deal with a voluntary petroleum allocation program, the 1974 truckers' strike, and the chlorine shortage in 1975. This system is considered to be one of the forerunners of today's systems.

At practically the same time, the Institute for the Future designed the PLANET/FORUM system for conferencing and messaging. This system was used by the United States Geological Survey to coordinate planning and budgeting of fieldwork, the United States Department of the Environment to coordinate information exchange among laboratories, and the National Aeronautical and Space Administration to coordinate experiments with the Communications Technology Satellite. Following these developments, several major international CBCSs came into operation: the Electronic Information Exchange System (EIES), designed at the New Jersey Institute of Technology; NOTEPAD, designed at Infomedia Corporation in California; and the COM system, designed at the Swedish National Defence Research Institute in Stockholm. These three systems are described more fully in the body of this report.

Computer-based conferencing can be expected to have both positive and negative impact on many kinds of information transfer at all levels of society. It can be an asynchronous means of communication and information exchange. Apart from the obvious benefits, such as removing time-zone differentials, asynchronicity creates several new opportunities. Individuals can utilize their time more efficiently by seemingly being in several places at once, dealing with problems and participating in communication and information exchange at a convenient time and rate that is not dictated by time zone or central meeting place constraints. Information can be disseminated and received in batches, thus reducing expensive on-line communication costs. Communications, inquiries, and responses can be composed at leisure, reducing the need for expensive translation and lessening the chance of misunderstanding. Frequently, options exist that enable use of a lower class of service or service at non-peak hours, thereby reducing costs considerably.

In the synchronous world, one can only be in one place at a time, e.g., reside at home or study abroad, serve at the country's capital or in the hinterlands, analyze data at the laboratory or collect it in the field; when attending a conference, a person can only attend one session at a time or, if engaging in corridor chatter, miss all the sessions at that time.

The computer-based conferencing environment, on the other hand, allows one to reorder intellectual and communication spaces through asynchronicity so that nothing is missed. An electronic conference allows the individual to view the transcript and enter into the discussion of all or as many sessions as desired, while forging informal linkages with others who are doing the same through the electronic equivalent of "corridor chatter." A person can be in the field rendering assistance or collecting information and still be in contact with peers at distant locations to obtain expert review and assistance. CBCS users can reside at home and maintain a steady stream of collegial contact. Similarly, they can remain close to their data sources and, thus, are able to ensure greater accuracy in communications. The net effect is that the individual and group can comfortably undertake more activities, monitor more information sources, and do these things with far greater efficiency.

From an information perspective, computer-based conferencing can offer: maintenance and computerized search and organization of all on-line transcripts of past and current communications to promote complete documentation and efficient utilization of time; collection of material from transcripts and other on-line sources to create on-line data bases, which can be custom designed to meet both group and individual needs; and electronic publishing to facilitate the rapid dissemination of information and to receive feedback.

It is important to realize that computer-based conferencing should be seen as a complement to conventional modes of interaction rather than a replacement for them. For many tasks, face-to-face meetings are essential but, for others, the use of computer-based conferencing can contribute significantly to the effectiveness of meetings through preliminary organizing and planning and post-meeting consultations; other meetings could achieve equivalent or better results by using computer-based conferencing alone. With travel costs rising, the cost benefits in this regard are obvious. In addition, ongoing research need not be interrupted so drastically as required to attend face-to-face meetings. When a CBCS is used in lieu of face-to-face meetings, the limit on the effective number of participants is increased to 100 or more from, perhaps, 10 or 20. Within these computer-based conferences, any number of participants can "speak" at the same time. An abrupt interjection cannot disrupt these meetings. In the same vein, subgroups can discuss and negotiate concomitantly with the "plenary" meeting with no adverse effects on the rest of the participants.

From the individuals' point of view, they can participate in many ongoing conferences via computer-based conferencing, which would be physically impossible with face-to-face meetings. As well, they could get reactions and comments from a large community of individuals to a paper or proposal in several days instead of weeks or months using conventional means. For the individual who uses this medium to replace some telephone usage, the time wasted in trying to contact colleagues can be minimized.

One of the more subtle effects of computer-based conferencing is its capability to bestow equality upon its users. Unlike most conventional forums, ideas expressed through a CBCS stand a greater chance of being judged upon their individual merits than by the attractiveness of their presentation or presenters. In a face-to-face forum, conscious or unconscious judgements may be made about ideas according to one's perception of the physical characteristics of the speaker, quality of voice, persuasiveness of tone, time of day, duration of the meeting, and many physical conditions that seldom have anything to do with the relative quality of the idea. Conventional print media carry their own distractions: quality of print, effective use of illustrations, prestige of the journal, and so on. Computer-based conferencing reduces all communication to a standard presentation. This feature can provide opportunities to increase scope, contacts, and exposure for junior researchers and groups that, for one reason or another, are considered to be "out" groups. It would seem that this form of equality could be of particular use in international forums where, unfortunately, all too often, stereotypes, prejudices, and other distractions may prevail.

Qualitative evidence, to date, indicates that the greatest impact of computer-based conferencing may be upon individual participants rather than the group. Individuals have reported that continual use of the process creates shifts in their behaviour by providing a content-rich stream of information from an ever-expanding network of new contacts, augmented by a system that enables them to manage spatial and temporal cognitive structures more effectively.

Moreover, afficionados report that their participation leads to new kinds of communication that would not have occurred without the use of this tool.

CBCSs appear to require a minimum number of members to become and remain effective. Generally speaking, the individual group's effectiveness is its ability to focus upon single problems. In addition, individuals report that through computer-based conferencing their personal roles become multivariate, enabling them to deal with a greater number of interests than is possible through conventional media.

It would be misleading to ignore the disadvantages of this medium, although the positive seems to overwhelm the negative. Perhaps the most serious disadvantage is the possibility of technical failure. This disadvantage comes into play only when comparing CBCSs with face-to-face meetings or conferences. Some of the advantages can also have a negative side. For instance, although computer-based conferencing opens up a new wealth of contacts and information, this can result in considerable information overload. The effects of this problem can be minimized if efficient file maintenance programing is provided by the CBCS being used. The computer-based conferencing process allows equality of participation through a more or less standard presentation but in so doing makes it much more difficult to relay emotional messages or other messages normally expressed by visual cues. Computer-based conferencing provides a measure of immediacy, but what if that participant with that vital piece of information does not reply to your message? Frustration and aggravation can result from the inability to force a reply when desired. In some societies or professions, typing is looked upon as a menial task unbefitting a professional. This attitude would impede the effective use of a CBCS. Finally, there is always the risk that the computer might be used to legitimize incorrect information.

In a world where communication plays such an important role, applications abound for this new communication tool. In the past, some of the most successful applications have involved crisis management. Perhaps, because of the emotional buffer provided by computer-based conferencing, it can be effective for international bargaining, negotiating, and conflict resolution. The benefits are again obvious for communication among common interest groups, whether in the national, regional, or international sphere. These interest groups might entail people with similar tasks but who are geographically dispersed; for example, individuals engaged in similar agricultural or medical research; users, designers, and managers of common computer systems, software packages, or international information systems; and groups involved in setting standards or legislation. For any organization that has regional offices, computer-based conferencing can offer a valuable management tool for program planning, budgeting, and interoffice communication. Where inquiry–response services are needed, there is scope for the application of computer-based conferencing to facilitate the connection of the inquiry with the required resources for the response. Examples of this would include conventional information and extension services.

Further down the road, the possibility exists for the application of computer-based conferencing in rural areas to assist regional and community communication and planning; facilitate joint scheduling of projects, planting, harvesting, marketing, etc.; and act as an educational aid. Finally, CBCSs can complement and replace some international or regional scientific meetings, conferences, and workshops. In fact, wherever there is the need for interdisciplinary study and discussion, computer-based conferencing can be effectively employed.

International Organizations

The control and use of CBCSs at the international level inevitably involves a variety of international organizations. Representatives of several of these organizations were invited to the workshop to describe the roles of their agencies, participate in the discussions, and assist in the preparation of the recommendations. The following summarizes the presentations given by the representatives, who were respectively: Carlos Giuliano (IBI), T. Okabe (ITU), Ronald Uhlig (IFIP), and Alec Lee (IIASA).

Intergovernmental Bureau for Informatics (IBI)

IBI was established in 1974 to "permanently assist people, in the field of informatics, to help them in the context created by this discipline, to understand better its impact on society and to derive the maximum benefit from its possibilities."

IBI is an international organization exclusively dedicated to informatics. It is an autonomous organization having its own general assembly, which determines the policy of the organization and establishes the biennial program and budget of IBI, and executive council, which approves the annual program and budget and controls financial administration. Membership within IBI is open to states that are members of the United Nations or one of its specialized agencies.

In addition to promoting national informatics structures, IBI also serves as a clearing house through which countries, regardless of their level of informatics development, can compare their respective problems and exchange ideas at international meetings organized by IBI. A recent meeting attended by important personalities and held under the auspices of the Government of Mexico produced the Declaration of Mexico on Informatics, Development and Peace, which has been signed by several heads of state. This declaration served as the platform for the launching of SPIN 83 (Strategies and Policies for Informatics), a world conference to be held in Havana, Cuba, in June 1983. At SPIN 83, decisions for immediate action will be taken and engaged by different countries to launch a U.S.$1 billion quinquennial program of informatics for developing countries. In preparation for SPIN 83, regional and sectoral meetings are being planned. In addition, IBI will invite the manufacturers of hardware and software, as well as service companies related to informatics, to meet in Havana to present information related to present and future products that should be considered in the program of SPIN 83.

A preparatory world conference open to all countries, institutions, and companies related to informatics will be held during 1982. This preparatory conference will take into consideration the documentation and program produced by the regional and sectoral meetings in an attempt to finalize the program that will then be ratified at SPIN 83.

It is felt that two factors differentiate developed from underdeveloped countries: capacity to process information, and managerial and administrative infrastructures. The inability to process information, coupled with the lack of administrative infrastructures, on the part of underdeveloped countries, is a crucial factor in the growing imbalance in the world economy.

To advance the capacity to capture and process information, and exchange information and information flows across borders, international debate and agreement are necessary. Informatics provides underdeveloped countries with an opportunity to achieve these capabilities, thereby contributing to the solution of their development problems.

To cope with the problem of manpower, for those countries opening up to informatics, IBI has implemented programs of technical assistance and training ranging from technical missions to long-term cooperative programs. Integrated training programs, organized in university centres within various countries or on a regional basis, complement the technical assistance programs.

To comply with the needs of countries wishing to implement or reinforce their informatics structure, IBI has developed "joint action programs," designed for countries with limited resources wishing to initiate informatics development, and "pilot projects," designed for developing countries and member states that have already acquired a certain level of informatics experience.

Through the continuing efforts of IBI, it is hoped that informatics, as a tool, will be beneficial in shortening distances in the development process to avoid the stagnation of emerging countries.

International Telecommunication Union (ITU)

ITU is an intergovernmental organization, made up of 155 member countries, whose purpose is to maintain and extend international cooperation for the improvement and rational use of telecommunications of all kinds; promote the development of technical facilities and their most efficient operation, making these facilities, as much as possible, available to the public; and harmonize the actions of nations to attain these ends. One means by which ITU attempts to meet these goals involves the creation, development, and improvement of telecommunication equipment and networks in developing countries by every means at its disposal, particularly its participation in programs of the United Nations.

Within the structure of ITU are two International Consultative Committees (CCIs), the International Radio Consultative Committee (CCIR) and the International Telegraph and Telephone Consultative Committee (CCITT), whose respective functions are to study and issue recommendations on technical and operating questions relating to radio communications and technical, operating, and tariff questions relating to telegraphy and telephony.

Technical recommendations presented by the CCITT must ensure compatibility between equipment, systems, and procedures in different countries so that international communication is possible, and also so that the quality of international communication is satisfactory. In this regard, the study of data communication by the CCITT is presently carried out in accordance with three approaches to providing facilities for data transmission: use of telegraph, telex, and telephone networks for combined operation with data services; use of a separate network dedicated to data-type services; and future use of an integrated services digital network.

The fact that ITU does not, itself, operate international communication links, has given rise to the creation of Plan Committees (World Plan Committee and Regional Plan Committees, both joint committees of the CCITT and CCIR, administered by the CCITT). At present, regional committees exist for Africa, Latin America, Asia and Oceania, and Europe and the Mediterranean Basin.

The World Plan Committee is responsible, either directly or indirectly through its regional committees, for: (1) establishing a general plan for development of the international telecommunication network to assist administrations and recognized private operating agencies in reaching agreements designed to organize and improve international services between their respective countries; and (2) examining the technical, operating, and tariff questions raised either directly or indirectly in the various regions of the world by the application of the different stages of the plan, making an inventory of questions of interest to developing countries, and setting such questions for study by one or both consultative committees.

As in the past, ITU's technical cooperation is continuing through the implementation of projects that can be grouped under three headings: (1) promotion of the development of regional telecommunication networks, i.e., in Africa, the Americas, Asia, the Pacific, and the Middle East, with a view toward their integration into a worldwide telecommunication system; (2) strengthening of national telecommunication technical and administration services in developing countries through the improvement and modernization of existing facilities; and (3) development of human resources for telecommunications through the establishment or improvement of national or multinational training institutions, in-service or on-the-job training, meetings and seminars, and fellowships in order to meet the manpower demand in various sectors of telecommunications in developing countries.

International Federation for Information Processing (IFIP)

IFIP is a multinational association of the national computer societies of 41 nations. Formed in 1960, its aims include the promotion of information science and technology and the advancement of international cooperation, research, development, and application of information processing. IFIP is chartered by Unesco, and many of its members are developing nations.

The organization has nine technical committees dealing with different subjects, with each committee spawning a number of working groups for specific studies. One of these is Working Group 6.5, International Computer Message Services. This group is looking into the possibility of using computer-based conferencing to solve some of the problems of communicating among scientists in different parts of the world.

The group concentrates on topics such as potential standards for messaging data structures, addressing, and higher level protocols that affect CBCSs. As a result of a workshop organized by the working group, in 1980, the IFIP Technical Committee on Data Communications adopted a series of recommendations concerning the operation of CBCSs, aimed particularly at Postal, Telephone, and Telegraph (PTT) regulating bodies and other responsible bodies such as CCITT (ITU).

The first of these recommendations was that organizations should be free to operate their own CBCS through the public networks. The second concerned

transborder communications, calling for a lowering of restrictions. Messages should not be subject to conditions that are more stringent than those applied at the national level to letter post.

Finally, on the subject of tariffs, the workshop recommended that tariffs should not discriminate against computer-based conferencing through artificially high rates, especially for international messages, and that charges for the preparation and sending of messages should be separated so that, where public services are not used for message preparation, the only charge incurred would be for transmission.

A new IFIP Working Group 6.5 subgroup, Messaging for Developing Nations, is just getting started. It is hoped that something may come out of this IDRC workshop in the way of a program of activities and that some of these activities may be carried out in cooperation with the IFIP Working Group 6.5 subgroup.

International Institute for Applied Systems Analysis (IIASA)

IIASA is a nongovernmental organization that applies scientific methods to the analysis of global and international problems. It has several programs of activity, one of which is the Management of Technology (MMT) Program. This is concerned with problems associated with technological change — from the point of view of either stagnation or development.

This program is divided into four "tasks." The first deals with public policy issues related to stimulating technological innovation. Telecommunications is one of the fields chosen for study in this area. The second area deals with the social and political impacts of information technology. This task group has just finished a review of the European state of affairs with regard to view-data systems. Two studies recently started are examining the impacts of transborder data flows and the use of communication satellites. The latter study is particularly concerned with applications in the fields of agriculture and education. This is the first MMT project that will directly involve some developing nations. Up to now, the institute has been something of a club for industrialized nations, but that is beginning to change.

The third area covered by the program is the management of technological risk. This involves the study of events of a very low order of probability, but with potentially catastrophic outcomes. The fourth area relates to forestry and forest products. A study is under way of world trade in the next 40–50 years and the potential uses of forests as sources of biomass energy. This study will involve the developing nations. The forestry program is rather large, and because IIASA does not have the personnel on site to conduct such a program, a collaborative arrangement has been made with institutions in several member countries and elsewhere.

IIASA has been using computer-assisted communications for some time, so in addition to conventional methods of exchanging information, such as visits and conferences, their own computer-based conferencing system, TELECENTRE, can also be used. At present, however, this system is used mostly for one-to-one communication because the policies of national PTTs have prevented IIASA from hooking everybody up. At present, only four member countries can use TELECENTRE for conferencing. The institute's separate communication network with the East European countries (e.g., Moscow and Prague) works with fewer institutional impediments.

Current Systems

The CBCS concept is not science fiction, it is already a fact of life. Numerous CBCS programs, some of them experimental, are already in everyday use, serving governments, universities, research institutions, and commercial enterprises. Experts closely involved with several existing systems were invited to the workshop to explain their operation and share their experience in the development and use of CBCSs. The following contains summaries of presentations made by: Robert Bezilla (EIES), Richard Miller (Infomedia Corporation), Jacob Palme (COM), J. Watson (SAM'S CLUB), and Liane Tarouco (UFRGS).

Electronic Information Exchange System (EIES)

EIES, of the Computerized Conferencing and Communication Center at the New Jersey Institute of Technology (NJIT), is now 6 years old. It is an ongoing experimental test-bed for developing new conferencing hardware and software and to evaluate its use and impact on a wide spectrum of user communities.

Initially, EIES was funded by the National Science Foundation, and early users were mainly scientists from the invisible colleges of such disciplines as general systems theory, futures research, social network analysis, and medical specialties. EIES is now user-supported, and draws from a wide range of user groups, e.g., artists and writers, handicapped children, senior citizens, television producers, science and technology advisors to state legislatures, industrial standards committees, and information scientists. Applications have included such diverse activities as joint creative-writing projects, television program production, international conferencing and reporting, national meeting preparation, and on-line writing and editing of books.

EIES is composed of several basic, easy-to-understand functions that can be combined to form complex structures to meet user-defined conferencing needs.

The system supports individual and group messaging, group conferencing, word and text processing, inquiry–retrieval functions, and electronic publishing activities. The laissez-faire structure of EIES allows individuals and groups to structure their own interfaces to the system, and has greatly facilitated interdisciplinary interactions among the groups represented on EIES. On-line membership directories are maintained to facilitate searches for other users who share similar interests or to find potential information resources. Writing spaces, known as "notebooks," are employed for individual, joint, or group writing activities. Most members, through the asynchronous and structural augmentation of EIES, can comfortably participate in from 10–50 different conferences and notebooks.

Users may interact with EIES by a variety of means ranging from simple menu-type commands to complex, programed interactions constructed through an experimental language, INTERACT, that was developed to facilitate

digital, verbal, and graphic communication in a conferencing environment. Assisting users are "user consultants," who act as intermediaries with peer understanding between the user groups and programing and systems design personnel of EIES.

At the heart of EIES are conferences in which members exchange views and maintain common transcripts of the proceedings. Except for public conferences, access is restricted to conferences to which users have been granted membership, i.e., group conferences are used for formal exchange of ideas and information; private conferences are maintained for discussion of specialized ad hoc topics; and value-added conferences present special programing features or topical contents for which members are willing to pay an extra fee. Information is "published" electronically through CHIMO, an EIES on-line newsletter; in prototypical electronic journals; and through conference-assisted inquiry–response networks.

Current experimentation is being undertaken in developing conferencing management tools; conducting electronic information barter through MARKETPLACE, an exchange forum that rewards users for their intellectual contributions; educational extension services, e.g., in the near future NJIT faculty members will use EIES to teach courses at six distant colleges that could not otherwise offer such courses to their students; and facilitating on-line data and information collection through automated forms, questionnaires, and consensus instruments.

EIES takes full advantage of the feedback mechanisms of conferencing and maintains a continuing evaluation and experimental program. To date, EIES associates have produced two books, 15 technical reports, and over 200 scholarly papers that have been derived from EIES experiments and evaluations. Internationally, in addition to an average of 600–700 members in the United States, there are currently 31 EIES members from 10 other countries in North America, the Caribbean, Europe, and Australia.

Infomedia Corporation

Computer-based conferencing is neither mass nor person-to-person communication. It can be considered a gateway to expertise, which offers access to another person, group, or data base. Phrases like "electronic mail" are inappropriate because they attempt to describe this new technology in terms of previous technology. This is the "horseless carriage" syndrome.

Infomedia is dedicated to commercial applications rather than being an experimental research tool like EIES. Its major clients are multinational corporations and agencies that engage in a large amount of overseas communication. Fields of operation include petroleum, heavy construction, and personal consumer products, where computer-based conferencing can be used for research, ongoing exploration, and site management and construction.

Infomedia has access to most of Western Europe and the Far East — Hong Kong, Taiwan, Singapore, Philippines, Australia, and New Zealand — as well as the Persian Gulf and, in the near future, Mexico and South America. Users have direct access via international record carriers to TYMNET and TELENET.

During the past 15 years, the cost of computer-based conferencing equipment has decreased significantly and although telecommunication equipment has gone down in price, the cost of telecommunication services has not dropped. Access to a CBCS does not require the high baud rate that access to a

data base does — optimal speeds may be 1200–2400 baud. Many users use an intelligent terminal to create messages that are then streamed into the CBCS. This can reduce connection costs by a factor of 5.

International access can pose problems; for example, overseas communication surcharges can be as high as the actual domestic cost. One group at Infomedia is solely concerned with international access and maintains a catalogue of telecommunication contacts and procedures for accessing TYMNET/TELENET in the countries of their clients; TYMNET provides the same service for its customers.

When dealing with local PTTs to establish a CBCS link, Infomedia has found it helps to present its system to a PTT as a private, dynamic data base of messages, similar to an information storage and retrieval system, rather than a general, for-hire system in competition with telex and telephone systems. Although, theoretically, one can belong to all conferences on a CBCS, the conferences are controlled by moderators and connected to projects, and users cannot move from one project to another. Problems with a PTT may also be technical if, for example, the PTT has purchased obsolete software. There may be difficulties in coordinating the PTT, domestic carriers, and the user.

Where network access does not exist, three options are available. One option is to call the nearest TYMNET/TELENET entry point or telephone directly to the United States. A second is to use a telex system through the ITT gateway in New York to TYMNET. The third is satellite access, which Infomedia is now investigating. In the next 2 years, Infomedia hopes to be able to provide small ground stations if local PTTs can be persuaded to sign an INTELSAT agreement. These stations need not be expensive — under U.S.$10 000 — to conform to INTELSAT standards. Such stations are currently being offered for use in remote areas of the United States by forestry services.

Computerized Conferencing System (COM)

The COM computerized conferencing system has been in regular use at the Stockholm University Centre since March 1979. It has been found to be an effective alternative to communication previously made by telephone, letters, or meetings and has changed communication patterns and increased exchange of information between people separated by vast distances.

Traditionally, computers have been used for information searching and retrieval, under the control of the recipient. At the opposite end of the spectrum lies electronic mail, which is originator controlled. Computer-based conferencing is a medium of communication that allows both the originator and recipient to control the transmission of information. The user can select conferences and retrieve desired information but can also introduce and direct messages to individuals or conferences.

At present, the COM system is installed on seven computers in Sweden and eight outside Sweden. Within the COM system two types of messages are possible: conference entries (available to all participants of a conference) or letters (directed to one or more specific people). The same message can, at the same time, be entered into one or more conferences and sent as letters to one or more individuals. Letters are of benefit to small groups with close interaction among each other. Conference entries, on the other hand, address a subject rather than a person, thereby serving larger groups and facilitating the transfer

of ideas. In this regard, one advantage of computer-based conferencing that surfaces is the availability of a large group to draw upon when solving problems.

In general, investigations have indicated that whether or not a CBCS is used is dependent upon the answers to the following questions: Can the system provide communication in areas of interest to the user? Is the value worth the effort to regularly connect to the system? Are there other suitable forms of communication available? It has also been found that computer-based conferencing is more successful when dealing with large groups (15–30 or more).

COM is used by employees at universities, public research institutes, and various Swedish defence agencies. Most COM users associated with defence are located within the National Defence Research Institute. Those at other defence agencies use COM as a result of cooperative programs with the institute. COM has users not only in Sweden but also in North America, Finland, Norway, the United Kingdom, Italy, France, and West Germany.

COM has increased communication opportunities, particularly for those participants with a low profile in terms of professional, administrative, or seniority status, an advantage that can be attributed to such systems in general, i.e., facilitating interaction between all levels of management. Another observation that has been made among COM users is that they have become less isolated and less dependent upon small groups. Organizational sociologists claim that organizations in which most contacts are made within small, closed groups tend to be more conservative and find it more difficult to develop and accept changes than organizations with good contacts at larger distances.

It should be noted that computer-based conferencing is not appropriate for all occasions. For example, although computer conferencing may be preferable for discussing ideas with a large audience, in situations where unanimous agreement must be reached on an issue, face-to-face meetings are superior.

Two additional projects currently being developed are: PORTACOM, a system developed and financed jointly by European countries, which has high user capacity, is portable, and is 90% functionally equivalent to COM; and GILT, a European project for developing a standard method for the interconnection and exchange of information between different types of computer message and conference systems.

SAM'S CLUB

SAM'S CLUB (System of Automatic Message Switching for Communicating Lucidly with Brevity) is a computer-based conference experiment designed to improve communication between individuals in several countries involved in planning, managing, and operating the International Aquatic Sciences and Fisheries Information System (ASFIS). The experiment, sponsored by the U.S. Environmental Data and Information Service (EDIS), of the National Oceanic and Atmospheric Administration (NOAA), is part of a series of computer conferences planned to test the benefits of this new mode of communication.

The system is accessible from most places in North America via simple computer terminals. It makes use of the United States commercial data transmission networks and a commercial computer system. In addition, SAM'S CLUB uses a computer conference program (CONFER) designed by EDIS.

International information systems are designed to share the effort and cost involved in achieving comprehensive coverage of a particular field and worldwide dissemination of the resulting information. There are three primary driving

forces behind the development of such systems: the need; the ability of cooperative information projects to forge ahead in spite of political pressures; and the cost factor, which necessitates cooperative efforts.

ASFIS is similar to these international information systems. Originating in the Food and Agriculture Organization of the United Nations (FAO) in the late 1950s, it is now cosponsored by FAO, the Intergovernmental Oceanographic Commission of Unesco (IOC), and the Ocean Economics and Technology Branch of the United Nations Department of Economics and Social Affairs. The major product of ASFIS is an abstracting and indexing service, Aquatic Sciences and Fisheries Abstracts (ASFA), which originated in 1970 as an abstracts journal. Since 1978, it has also been issued in machine-readable form.

The approach with SAM'S CLUB was to introduce the new communication medium into an ongoing situation and then observe change, if any. SAM'S CLUB is small in comparison with some computer conferences. Its uniqueness lies in the application to managing an international information system. Except for the users' terminals, all of the hardware is owned and operated by private companies. A PDP-10 computer system in Ann Arbor, Michigan, or another in Waltham, Massachusetts, links users via packet-switched data communication networks. SAM'S CLUB uses EDIS CONFER to handle the input, output, text editing, and message routing functions, but, in turn, makes use of a versatile general purpose data base management system known as System 1022, a software package providing the file management and text storage and retrieval functions.

As in the case of other systems, SAM'S CLUB has been utilized as an alternative to or extension of traditional telephone, telegraph, and face-to-face methods of communication. Although presently still in the experimental stage, SAM'S CLUB appears to be a timely management tool that is helping cooperative international information systems to achieve their goal.

A problem that did arise, regarding international connections, involved the centre in Mexico. Mexico had free access via TYMNET but had to pay if using TELENET. The contractor supplying computer services then made a private decision to dispense with the TYMNET connection, which left Mexico in the position of having to pay to get access to SAM'S CLUB. Apparently, this caused a serious problem for the Mexican centre, which stopped using the system until TYMNET was reconnected.

Universidade Federal do Rio Grande do Sul (UFRGS)

Communication problems exist in any developing country — it may be easier to communicate outside the country than within — and are aggravated in Brazil by great distances between communities. Face-to-face meetings are limited by time and travel costs, and may be attended by the wrong people, e.g., executive rather than technically-oriented personnel. UFRGS found that the implementation of a CBCS connecting universities with programs of scientific research was a solution to this problem.

UFRGS considered buying a CBCS but felt that it was more important to probe human resource capabilities to use new technology and decided instead to build its own system. The first CBCS was primitive, but the group learned from the experience and went on to design a bigger and more complex system. It is better for a developing country to learn-by-doing rather than to simply become a user of technology.

The Brazilian telephone company offers an analogue line. A packet-switching network will be available in 1983; telex is also used to access computers.

One problem typical of developing countries is cost/benefit relations, where benefits are long term but costs are short term. Currently, LARC, an association of universities in Brazil, is trying to build an experimental packet-switching system and needs government help. The government, however, is reluctant to allow LARC to have a free line because it fears other institutions will want one also.

Another problem is the social impact of the new technology. Users are concerned about personal privacy and job security. People are afraid that they could be replaced by machines.

An important aspect to consider is the need to disseminate the benefits of this new technology in the country as a whole, including also the remote areas that are usually omitted because of cost. When one thinks, on the other hand, in international terms, one should not forget the legal problems. Transborder data flow, for example, is a very important concern for many governments, resulting in the restriction of information leaving the country.

Many developing countries may also face the need for translation. In Brazil, only a small community could make use of a CBCS with English dialogue. For wide ranging use, Portuguese dialogues would be preferable. For example, at UFRGS a text-processing system remained unused until another system, with dialogue translated into Portuguese, became available.

Proposed Systems

In attempting to answer the question of whether or not computer-based conferencing is an appropriate technology for use in developing countries, several of the workshop participants presented proposals for actual system applications. These proposals, which demonstrate the wide-ranging potential of CBCSs for development purposes, are summarized in the following. The first three were presented by S. Ramani, the final proposal being presented by Carl-Göran Hedén.

Development Information Network (DEVNET)

A major obstacle to information flow among developing countries is that relatively few are linked to each other to enable the regular exchange of information. What developing countries need is a permanent network to supplement traditional Western-oriented flows of news, opinions, and facts.

The Technical Cooperation among Developing Countries (TCDC) conference held in Buenos Aires, and various subsequent international conferences have emphasized this need. Since the Buenos Aires conference, in 1978, the United Nations Development Programme (UNDP), in pursuance of its mandate to promote TCDC, has been exploring the possibility of implementing a network linking the various people involved in development processes within developing countries. From this, the Development Information Network (DEVNET), an information collection and dissemination network based on the newswire service mode, was proposed. In a multiregional feasibility study that was carried out, a number of countries indicated not only an interest but also a willingness to support the proposed system.

Being a subscription service, the network will be a nonprofit, nongovernmental institution using a purpose-designed switching and coding system to carry information directly to appropriate users, matching their specific information needs.

Initially, the network will cover 60 developing countries, but will be capable of expanding to include all of the developing nations. The primary users of this network are expected to be governmental and nongovernmental decision-makers, private and public business enterprises, banks and financial institutions, professional and trade associations, research institutions and universities, labour organizations, and the media. The network will have six regional bureaus, which will receive and process information from national bureaus. An international coordinating centre will also be established.

Users will be able to feed information into the network through their national bureau. Because the information carried on the network will identify the source, users will be able to ask for more information on any item they desire. The network, in its initial stages, will distribute up to 8 h of transmission per day. The

system is to be capable of transmitting at a rate of 50 baud, giving it a capacity of about 100000 words/day for each regional bureau.

As the necessary intercountry and interregional links are established, DEVNET is designed to become an effective vehicle for cooperation among developing countries in scientific, technical, economic, cultural, and other spheres.

CBCS Design Considerations Relevant to the Developing World

The advantages of CBCSs in the developing world, as in the developed nations, are numerous. This medium of communication can effectively increase the size of communities of researchers interested in similar disciplines; provide more visibility to individuals and their work, creating a more stimulating and challenging environment; replace, to a certain extent, the dependence of developing countries on international journals (with their excessive lag time) for keeping abreast of work elsewhere in the world; and facilitate the sharing of programs, data, and general information of common interest.

Computer-based conferencing is uncommon in the developing world not because it is expensive or impractical but because it is a new idea. In these areas, travel to meetings and traditional means of communication, e.g., telephone, are often too expensive, difficult, and unreliable. With the appearance of low-cost computers and decreasing communication costs, large centralized systems are becoming increasingly unattractive. New system architectures are now necessary for new systems. In areas where data communication is still expensive and where high bit rate channels are unavailable, the low cost of small computers encourages the design of networks where each node consists of a computer providing on-line retrieval functions as well as being capable of communicating to the other nodes for messaging, conferring, or retrieval purposes. Each multipurpose terminal could be shared by 10–20 researchers with one hard-copy terminal for every few video display units. Data links within the developing nations and to the developed world are available but not in the best possible form. Switched circuits with dial-up terminals are difficult to use, suffer high error rates and breaks in communications, are sometimes illegal due to problems caused for the local telephone network, and are usually expensive. Dedicated data links, from Asia to Canada, operating without any problems at 3200–4800 BPS from cities with a short link to an earth station, are possible at a cost of approximately U.S.$200000 per year. Dedicated teleprinter circuits operating at 50–75 BPS, on the other hand, could provide an Asia – North America link at an approximate cost of U.S.$60000 per year.

For the immediate future, it might be better to opt for slower speed, lower efficiency, and lower costs by using teleprinter lines to link researchers via CBCSs. The choice of data communication links is an important one from the cost/benefit point of view.

What is necessary to get this new technology off the ground in a developing country is a convincing demonstration project to show the benefits to the research communities and the policymakers. Attention should be focused on local networks in the short term, not on the international data carriers.

A Communication Satellite Dedicated to Computer-Based Conferencing

Special problems are posed when trying to implement a CBCS in geographical areas where no public data networks exist. In most areas of the world, access to a CBCS would be through modems operating on an analogue telephone network. Depending upon a telephone network not designed with this application in mind brings with it a number of problems: poor quality cables, switching equipment, and modems; insufficient capacity; and a high cost for international interconnections.

Existing communication satellites have not eliminated the problems because they, too, were not designed for CBCS applications. It is necessary to investigate a new type of subsynchronous satellite dedicated to facilitating asynchronous communication. Using a low-level (300–5000 km) equatorial orbit would allow distribution of messages globally without extensive internetwork connections. Because most communications would be compact, a few thousand bits per message, a single 64 000 BPS narrow-band transponder would be sufficient to handle thousands of small earth stations. These stations would range from microcomputers or minicomputers with individual transceivers and a single terminal to larger computers with 20–30 terminals per transceiver. Each earth station computer would consist of the necessary hardware and software to provide computer-based conferencing facilities. The narrow bandwidth required and low orbit reduce the transmission power requirements of both the satellite and earth stations and allow the use of VHF or UHF frequencies. Through the proper use of directional antennae at the earth stations, transmitting power in the range from 1–20 W would be required for the proposed satellite. This could be met utilizing solar panels, especially considering that the power could be shut down when crossing oceans and that only coarse attitude control would be required.

Control and security aspects would necessitate a system control channel to pass on control information to the on-board computer and to assist in monitoring and management of usage.

By polling earth stations equipped with low-cost communication equipment as it passed over, the satellite would collect and store messages, which it would then forward to the appropriate earth station as it orbits the globe. One of the greatest benefits of such a system would be direct reception from the satellite, allowing communication at low cost to remote areas. The choice of orbit size would have a major impact on performance. At a higher altitude, the communication beam would exist over a region for a longer time but the passes would be less frequent. In this case, communications within a region would be delivered with almost no delay. At a lower altitude, guaranteed delivery time would be reduced because of its low orbiting time but the extent of intraregional communication on each pass would be more limited. Perhaps the use of two or more satellites with more complex software would eventually provide a more powerful and dependable system.

Ideally, the messaging and conferencing facilities could be provided in a variety of ways through single-user microcomputers or multiuser computers of larger size. These should be separated from the communication control microprocessor, which would be identical in all user installations. These micropro-

cessors should be able to accept messages in a standard format directly from a terminal or teleprinter, making a conferencing computer nonessential.

The on-board computer should, ideally, be capable of storing all communications received during one orbit (up to 20 megabytes) but this is not a rigid requirement because much of the traffic within a region would be switched instantaneously. By using a reservations technique for transmissions, the satellite could have a high throughput, perhaps of the order of several hundred million messages per year, averaging several hundred characters each.

The applications and benefits of such a system to the developing world are many: remote and rural areas could benefit from low-cost communication, national and worldwide telegraphy could be altered dramatically, a broadcast videotex service could be provided for various regions, and common interest groups would gain immeasurably from the advantages offered by this new communication medium.

Global Links for International Action (GLIA)

The network of nerve cells in our brain is fed and supported by what are called glia cells. Just as the brain coordinates our movements, so too computer-based conferencing can permit scientists to cooperate in international problem-solving efforts. These efforts need the same kind of support as that provided by the glia cells, except in this case in the form of funds from donor agencies instead of sugar and information from data banks instead of macromolecules.

The problems of developing countries now assume proportions that make it evident that the slow process of infrastructure building must be supplemented with goal-oriented, worldwide efforts involving a spectrum of interacting experts. As stated in the Declaration of Mexico, "The traditional forms of regional and international cooperation are insufficiently flexible and imaginative to meet the new needs. Hence new forms of cooperation must be urgently devised so as to ensure greater participation and enable the anticipation of problems before they arise." Computer-based conferencing could be the lubricant for new forms of cooperation linking various GLIA clusters located at centres of excellence.

The choice of the problem to be addressed, from the point of view of relevance to developing countries and also with regard to scientific challenge, is critical. As well, the size of the resource base for the conference is critical to ensure that the effort is self-propelling. Three factors must be considered when defining the target area: the global and scientific dimensions and the catalytic potential. With respect to the global dimension, food and fuel are obvious priorities. From a scientific point of view, these two areas overlap in a dynamic methodological field: genetic engineering/biotechnology. Consequently, the opportunities for cooperation are excellent if one agrees to choose a significant topic such as bioconversion of lignocellulose (wood, straw, municipal waste, etc.) Lignocellulose, for instance, in the form of woodwaste, is an underutilized resource that can be converted not only into versatile energy sources (biogas and alcohol), using small-scale equipment, but also into nutrients (sugar, amino acids, and single cell proteins). Its production requires water, but its use in large-scale practice often causes water pollution. Finally, lignocellulose can, of

course, serve as a raw material for small-scale industries (mushroom cultivation, etc.). This topic also has the advantage that it could gradually "mature" into a cluster of specialized miniconferences: pretreatment for enzymatic degradation, mixed culture techniques, genetic engineering for cellulases and lignases, energy analysis of alternative strategies, settlement impact of integrated bioconversion systems, etc.

Advances in genetic engineering and molecular biology, coupled with fermentation and other techniques, present a general framework for a biotechnology attracting world attention to its potential for solving some of the serious problems of mankind. As a consequence, the United Nations Industrial Development Organization (UNIDO) is now in the process of launching an International Center for Genetic Engineering and Biotechnology (ICGEB). It has been proposed that this centre should use computer conferencing as a tool to achieve a coordinating and catalytic effect.

A number of other organizations are active in this transdisciplinary activity in Sweden. The Microbiological Resource Centre (MIRCEN) in Stockholm is using the International Inventor Award (IIA) as a vehicle to explore the conditions for concerted action in this field. The International Federation of Institutes for Advanced Study (IFIAS) is active through its energy analysis and self-reliant development programs as well as its efforts to promote cooperation in the field of enzyme engineering. Other Swedish organizations with similar interests are the Foundation for Ecological Building Practices (EKOBYGG), Beijer Energy Institute of the Royal Swedish Academy of Sciences, and International Foundation of Science.

The communication network that IFIAS is now establishing between its many member institutes, supplemented with similar links between the World Academy of Arts and Sciences (WAAS) "resource people," and the network of MIRCEN laboratories, will, hopefully, serve as a useful matrix for a gradual expansion of IIA's feasibility study on computer conferencing. Noting the fundamental importance of precise need definitions as triggers for inventiveness, the Salen Foundation, a year ago, decided to supplement the IIA effort with a grant permitting the exploration of computer-based conferencing as a need-definition tool. This project, COMCON, has now reached a stage when international links can be considered. A natural first link would be to Ottawa, Canada, to tap the resource base at the National Research Council of Canada and various Ontario universities where some world renowned specialists in this field are located.

Because all of the organizations mentioned are heavily involved in development issues, it is reasonable to assume that they would actively contribute to the suggested feasibility study on the bioconversion of lignocellulose. Beyond that, however, they are likely to use the experience gained to further their individual interests: IFIAS would use it to strengthen the bonds between its member institutes, MIRCEN to improve contacts between sister laboratories, and IIA to expand its efforts to improve need-definition techniques into nonbiological fields. In addition, WAAS would use it to improve communications between its officers and its fellows, and UNIDO would employ it as a communication tool for ICGEB's scientific board and as a means to support regional activities, etc.

Using a step-by-step approach, after having created the network of GLIA clusters at Vienna, Stockholm, and Ottawa, the next step would be to forge the interconnection with institutions involved in similar reserach in countries such as Brazil and the Philippines.

Discussion

A verbatim record was not kept of the discussion that followed each presentation, the objective being to keep the workshop as informal and freewheeling as possible. However, a rapporteur was present at each session to record and summarize discussions. The following contains a synthesis of the rapporteurs' notes from each session. For convenience, the material is divided into three sections under the same headings as the material presented earlier. The presentation is not in chronological order and, because the views of several participants have sometimes been condensed into a single statement, no names have been used in the text.

A particularly stimulating contribution was made by Gordon Thompson, which was far broader in scope than most of the discussion of the workshop. It raised very fundamental questions about the type of investments that are being made, or should be made, in the developing countries, and about the responsibilities of industrialized countries when advising on such investments. This presentation is summarized in Appendix II.

International Organizations

It is technically feasible to send a message from anywhere in the world to any other place in the world via satellite at very low cost using a computer-based system. The technology either already exists or will exist within a few years. The costs of computer hardware are continually going down, although the cost of the services and the software are not declining at the same rate. The typical capital cost for a moderate bandwidth ground station may range from U.S.$15 000–$20 000, with the software costing a little more.

Because it is so relatively inexpensive, there is a danger that PTTs will ignore computer-based conferencing in their plans and continue to put major emphasis on the more lucrative services such as telex, TWX, and international telephone and data services. Computer-based conferencing, however, is very different from telex messaging, and it is necessary to make this distinction very clear in any dealings with PTTs regarding access to CBCSs. The system is a dynamic data base, not just a tool for sending messages from point A to point B. Some European PTTs are now beginning to acknowledge this fact, and there are indications that a relaxation in regulations is likely.

The CCITT (ITU) is now studying the entire field of what ITU prefers to call electronic message systems, with a view toward developing message standards that could be used for the interconnection of message systems from one country to another or within a country. This type of standardization should help to overcome some of the present problems with CBCSs.

Overcoming technical problems will be relatively simple — the skills and technology already exist, at least in industrialized countries. Other, less tractable problems, however, could present a major stumbling block to the global

development of CBCS programs. For example, there may be political and ideological objections to such development. Competing political objectives, therefore, will need to be carefully weighed against the obvious benefits.

The role of the IFIP Working Group 6.5 subgroup on Messaging for Developing Nations will be of considerable importance in handling problems of a political nature in the future. This is also an area in which IIASA may be able to play a role, particularly in view of its increasing involvement with developing countries. If the full potential of computer-based conferencing is to be realized on an international scale, permitting developing countries to have the benefit of access to the scientific base of the developed world, then every effort must be made to improve the present legislative and regulatory climate. If national PTTs refuse to allow the use of computer-based conferencing technology in their countries, they would be, effectively, disenfranchising their people from the international exchange of scientific information. Many could, indeed, take advantage of the fact that they do not have a large, standing investment in outmoded technology and could, therefore, introduce computer-based conferencing technology into their current development plans.

Current Systems

One of the principal advantages of computer-based conferencing was seen as its levelling effect, e.g., handicapped persons and the elderly are able to participate as equals in conferences that they might not otherwise be able to attend.

It has also been observed that participants of computer conferences notice psychological benefits when using CBCSs as a replacement for face-to-face meetings because they spend more time, proportionately, actively writing (talking) than passively reading (listening).

Users of CBCSs should be aware that the system can be misleading, particularly where different languages are involved and translation may lead to misinterpretation. Misunderstandings can also arise because the messages are not supported or qualified by the body language, tone of voice, or facial expression that goes with face-to-face communication. One solution to this potential problem is to conduct "crisis games" on the network to demonstrate to participants how dangerous the tool can be under the wrong circumstances. There may also be a need for some control of the use of CBCSs within organizations to avoid frivolous or malicious use of the system.

Although these potential problems exist, the need for some form of "censorship" on existing networks has not arisen because, for the most part, they are self-regulating. Each conference or group has a moderator, who is able to control the proceedings to some extent, and anything approximating antisocial activity tends to be rejected by the group as a whole.

Another potential difficulty with CBCSs, particularly in the early stages within developing countries, is the danger of information overload. Access to a CBCS provides the user with an incredible smorgasbord of data that may confuse the inexperienced user and actually impede the search for information. In this sense, those experienced in the use of existing systems have a very important role to play as "gatekeepers," helping to ensure that the right people receive the right information at the right time. Care must be taken, however, to ensure that such a role is not seen as an attempt to restrict the amount or type of information being made available.

The Brazilian experience in developing an experimental CBCS to link universities outside of the country's major centres to each other provided some valuable lessons. It demonstrated the importance of simplicity in system design and the value of learning by doing rather than simply importing technology from developed countries. For instance, it was found necessary to design two types of access: a tutorial, question-answer system for beginning users and a faster, more sophisticated approach for those more familiar with the use of computers. It also showed that there is no need to develop new hardware as existing hardware can be adapted to fit different systems, but attention must be directed at software development.

Perhaps one of the best investments a research-funding organization such as IDRC could make in this field would be to provide opportunities for people from developing countries to share these kinds of experiences. In this way, indigenous systems could be developed where they are needed, while the participants learn how to get the most out of their equipment.

One important effect of the use of CBCSs among groups of scientists has been its strengthening of the so-called "invisible college" system that exists among scientists working in specific fields. Far from weakening the system, as might have been feared, the use of CBCSs seems to promote cooperation among scientists rather than competition, as tends to be the case where this type of communication is not maintained.

By announcing a discovery on the CBCS, the scientist involved in a basic research program not only automatically claims credit for the discovery at once (rather than having to wait years, perhaps, before it appears in a scientific journal), but also invites colleagues to participate in the discovery and assist in its development. In this way, a CBCS can be seen as a valuable instrument in promoting new developments at the forefront of technology.

Proposed Systems

Discussion on proposed systems covered a wide range of options. It was generally agreed that many of the present problems with communications in developing countries are largely related to communication hardware. Because of its relatively low cost and simplicity, the microcomputer could well be seen as the tool that could enable the developing countries to catch up to the technology of the developed countries in the communications field.

Where existing systems are offered on large, mainframe computers it is because they were developed on these computers. In the next few years, however, it is extremely probable that software systems for CBCSs will be made available for microcomputers. By clearly separating functions and dedicating one microcomputer to each, it should be possible to duplicate the types of systems offered on larger computers at a cost reduced by at least one order of magnitude.

Drawbacks of microcomputers include their fragility, which would require a good deal of regular maintenance on the part of the user. Further studies on the use of this rapidly developing technology for computer-based conferencing, however, could be productive.

Much of the discussion centred around the proposal for a relatively inexpensive low-level communication satellite to be used exclusively for computer-based conferencing. Amateur radio groups within the United States already

have several such satellites in orbit. It should be well within the capabilities of a group of developing countries or even individual countries, therefore, to develop a satellite of this nature. The satellite, of course, would only be a part of the total system, the cost of which would be well beyond IDRC's budget, and, in any case, is not within the Centre's mandate. However, it might be of interest to large development agencies. Although some of the costs for transmission equipment, etc., would be picked up by the participating countries, it seems likely that a degree of international funding would be needed to assist in initiating the project and launching the satellite.

The problem of frequency allocation should not be too difficult to overcome because the system would operate on a very narrow bandwidth of, probably, less than 0.5 MHz. Similarly, finding an orbit should not be difficult, given the proposed altitude and the fact that the satellite would be on an equatorial rather than polar orbit. It would help in overcoming any objections if a common interest group could be identified, such as an international university group, a group interested in information on technology for development, or, perhaps, a group from the United Nations Assembly on disarmament, which is currently examining the possibilities of redeploying military technology for civilian applications.

A major problem internationally could, again, be competing national goals and the conservative attitudes of many PTTs. It was felt that to overcome these problems it would be necessary to demonstrate the obvious benefits to obtain the solid backing of the PTTs in cooperating countries. Here, too, the formation of a special interest group (or groups) could help in convincing the PTTs of the benefits that would accrue to them, in addition to the benefits to national development from international scientific cooperation.

A feasibility study on such a system could fall within the mandate of IIASA and could, perhaps, be undertaken as a joint project in cooperation with IDRC and other national or international bodies. IIASA is, in fact, currently running a joint project with INTELSAT that could provide invaluable experience for such a study.

There was also some discussion on the possible use of radio. One proposal outlined a data hookup system similar in nature to VIDEOTEX but based on voice only — it might be called AUDIOTEX. Such a system would be relatively simple to create, considerably less costly than a video based system, and could use either radio or the phone system.

The development of packet radio was considered to be another important area for developing country researchers to look into. At present, a small amount of research is being carried out within India. The field has great potential because the electromagnetic spectrum in most developing countries is not overcrowded by a large number of radio- and television-broadcasting stations. The possibility of a nationwide network of universities communicating via packet radio was one example of the potential use of this type of technology.

The proposed GLIA network was seen as an application that could bring together developed and developing countries to work on projects of mutual interest. Again, IIASA was seen as a potential catalyst for this type of undertaking. Another suggestion was the establishment of cooperative research on a South–South basis, with, perhaps, one developing country researching hardware aspects of computer-based conferencing, another doing software research, and another responsible for policy research.

Conclusions and Recommendations

On the 4th day of the workshop, the participants were split into two groups to prepare recommendations for action. One group was concerned primarily with action at the national and regional level, the other at the international level. The resulting two sets of recommendations, together with a statement of the groups' conclusions, were discussed and refined during the final plenary session. Subsequently, they have been merged into a single document, the credit for which belongs entirely to the workshop participants.

Conclusions

We expect that in the next decade the use of computer-based conferencing systems (CBCSs)[1] in developed nations will become a major vehicle for domestic and international scientific and technical information exchange.

We believe that the provision of adequate and reliable CBCSs to serve the scientific and technological communities nationally within developing countries and internationally among them and with developed countries would greatly contribute to the successful development of these communities.

It is our belief that unless the developing nations can participate in this electronic community of science and technology they will suffer from a disenfranchisement of a serious nature.

We perceive the threat of scientific and technical disenfranchisement to be twofold: first, the lack of access to the resources of the developed nations and, second, and perhaps more important, the inability to gain timely access to results and techniques found in the developing nations themselves.

Increasingly, international research is being undertaken in such areas as forestry (the proper utilization of biomass resources), agriculture (the development of nonplantation resources), and bioengineering (interdisciplinary synergies that interact with the above). Computer-based conferencing would greatly assist the participation of developing nations in these and other international areas of research by enabling them to obtain and exchange scientific and technological information and contribute innovations and information to the worldwide scientific community.

We perceive the technical requirements for full and effective utilization of international computer-based conferencing for any country to consist of the

[1]A CBCS combines computing and telecommunications technologies to permit the exchange of information between people by receiving, storing, and allowing retrieval and redistribution of text messages guided by instructions from their originators and recipients and by knowledge of what each individual recipient has received so far.

availability of CBCSs, availability of reliable domestic and international telecommunication facilities and services, indigenous technical expertise in computer-based conferencing, and domestic implementation of universally accepted procedures for CBCS interconnection. Additionally, we see the administrative requirements for full and effective utilization of international computer-based conferencing for any country to be effective representation to ITU and relevant committees in compliance with their procedures; the existence of indigenous applications expertise; an informed approach by government to transborder data flow policies in relation to scientific and technological information; the existence of a governmental focal point for facilitating the implementation of computer-based conferencing and the existence of a professional organization with the objectives of promoting indigenous expertise, identifying communication needs, and ensuring international representation in professional forums.

Recommendations

Recommendation 1

That IDRC undertake activities to encourage and, possibly, support the production and distribution of information resources, e.g., handbooks, which include a continuing survey of carriers (telex, packet switching, satellite, etc.) and instructions on access procedures; glossaries and thesauri of CBCS terms; bibliographies; CBCS documents; written and audiovisual material to introduce CBCSs; and a registry of computer-based conferencing research within developing nations and the persons involved. These materials will facilitate the exchange of information on computer-based conferencing technology and its use for developing countries.

Recommendation 2

That IDRC support regional workshops in Latin America, Asia, and Africa on CBCSs using IDRC regional staff working in conjunction with IFIP, IBI, and regional/national organizations. These workshops should become a focus for developing an awareness of the potential of such systems, eliciting national and regional needs, and identifying people and projects that might be given further support. Recommendations for national policies could result from these activities.

Recommendation 3

That communication among participants in such regional workshops be maintained through the support of ongoing national/regional CBCSs. Development of low-cost CBCSs, to be operated on a regional or national basis, is considered essential to this ongoing activity. Such systems should be compatible with other international CBCSs and capable of being enhanced by new technological developments. They should have the potential to use any available telecommunication network, including the switched-voice network, public-data networks, telex, teleprinter channels, etc.

Recommendation 4

That IDRC provide support for the development of national/regional centres

to allow the operation of CBCSs to facilitate communications related to specific scientific and technological research topics. An example might be the bioconversion of lignocellulose, in which there is considerable international interest.

Recommendation 5
That IDRC support a pilot CBCS project involving both developed and developing nations, e.g., lignocellulose research in North America, Europe, the Philippines, Brazil, and other interested countries.

Recommendation 6
That IDRC encourage scientific groups in developing countries to establish communications among their members by using computer-based conferencing facilities within their nations. This encouragement should include education and information on computer-based conferencing applications and financial support, in a catalytic sense, for equipment and services, which might be provided by IDRC itself or in partnership with other donor agencies.

Recommendation 7
That IDRC support a feasibility study for the development of low-cost, narrow-band ground stations for research institutions.

Recommendation 8
That IDRC support a feasibility study for international nongeostationary satellites for computer-based conferencing in developing countries.

Recommendation 9
That IDRC support a feasibility study to assess the costs, system sizes, and timing of availability and demand for a coax- or fibre-based telecommunication infrastructure.

Recommendation 10
That IDRC and IBI consider the possibility of initiating a research project to analyze in depth the administrative/regulatory restraints that hinder the implementation of computer-based conferencing in a developing region (possibly Latin America). The researchers should recognize that computer-based conferencing is a newly emerging technology that is not well understood and that broad important national interests exist (e.g., revenues from traditional communication channels). The potential compensating national benefits of encouraging computer-based conferencing need to be identified.

Recommendation 11
That IDRC provide support for the regular exchange of information on emerging national projects using this new means of communication; for example, by supporting a continuing computer conference to maintain contact among the participants of this workshop.

Recommendation 12
That an advisory group of people experienced in the development and use of CBCSs be formed to provide a continuing focus for implementation of the

recommendations of this workshop and to develop more specific plans for IDRC action. It is considered essential that participants from developing countries be included in this advisory group as is already the case within the IFIP Working Group 6.5 subgroup on Messaging for Developing Nations.

Appendices

I. EIES Conference

In the hope of obtaining maximum input from researchers and others already involved in computer conferencing, IDRC sponsored a public conference on the Electronic Information Exchange System (EIES). This was IDRC's first direct experience participating in a computer conference.

CC for Developing Countries (1015), as the conference is known, began on 29 September 1981. Responses began to come in almost immediately, although, in the early stages, not in great numbers. During the workshop, IDRC entered daily reports on the discussions that took place and summaries of some presentations. Later, the participants' conclusions and recommendations were entered. By 27 November 1981, 71 conference comments had been entered.

For the benefit of those who have never had the opportunity to participate in a computer conference, the following selection of comments is provided to illustrate the use of this medium. For the sake of authenticity, no attempt has been made to "clean up" typing or other imperfections and editing has been undertaken only to remove references to other comments where these might be confusing.

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C1015 CC1  (ANONYMOUS)   9/29/81  10:44 PM  L:14
KEYS:/INWELCOME COMMENT/

 Welcome from IDRC to this conference!

We are basically interested in looking into the barriers (technical,
economic, political, legal, cultural) to the use of computer
conferencing, computer based message systems, electronic mail, etc..
in developing countries as well as between them and developed
countries. In addition, we wish to identify methods by which
organizations, interested in assisting developing countries' research
capabilities, can facilitate the development of global and regional
networks which involve these countries.

 This conference is open to all and we welcome your contributions.

C1015 CC2  ROBERT COWAN (ROBERT A,271)  10/ 1/81   9:03 PM  L:42
KEYS:/ENVIRONMENT/TELECOMMUNICATIONS/PROBLEMS/

     The potential application of this form of technology may well be
an excellent suppliment to additional forms of communication and
transportation.  My field is teleconferencing and I have worked on behalf
of some LDC's is assisting them in the development of telecommunications
systems to reach remote areas for several objectives.  The management
of a political system (government business) is certainly an important
element, but I have tried to bring several other issues into focus.
     In many areas the quality of telephonic communications leaves much
to be desired.  The problems with telephone lines (reliability of the
circuits) is certainly a difficult area.  The use of satellite
communications bypasses some of the problems associated with the
failure of remotely located microwave repeaters, but the problems of
adequate electrical supplies (stable generating facilities) and repair
personnel also exist.  These issues affect any form of electronic
systems that are introduced.  In addition, the climatic problems are
well known.  It is difficult to get any U.S. made electronic system to
work reliably in an environment with unstable, spike heavy electrical
supplies; with high humidity and temperatures; with high dust content;
and user abuse, due to lack of knowledge and social values which do not
include considerable respect for mechanical devices.
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Assuming that there are regions where these variables can be controlled, it is important to diversify the utilization of the technology as much as possible.

From a health standpoint, the most important person in a bush area is not the government official nor the teacher, but rather the person responsible for waste treatment and the water supply. Without that individual considerable damage may be done to the entire village that would take months to repair. Sickness coumean that crops are not brought in, houses not adequately equiped for the winter or rain months, etc.

The perspective that I have discussed has been oriented toward the development of systems (communication modes) that seek to meet the needs of the individuals that are key to the long/short term survival of the PEOPLE in the village. One of the key issues in training and RETENTION of key individuals in the village.

From my perspective, one cannot meet those needs through a single communications modality. Just as some people do better with an essay test rather than a true-false quiz, some retain information from different sources more effectively. This is especially true in some cultures that are more visually based than textually based.

I would appreciate some response as to whether these comments are in the spirit of the your conference objectives.

C1015 CC3 INT. DEVEL. RES. CENTRE (IDRC,291) 10/ 2/81 3:59 PM L:4
KEYS:/TELECOMMUNICATIONS/PROBLEMS/
A: 2

Absolutely! We are interested in any and all opinions on this subject. I would like to hear more about some of your experiences... where you saw chances for successful application of this technology, where it's impossible .

C1015 CC5 ROBERT COWAN (ROBERT A,271) 10/ 5/81 2:54 PM L:37
(ORIG.) 10/ 2/81 6:32 PM L:37
KEYS:/VALUE PROGRAMMING/TYPING/NON-INTELLE /

Primarily my interests have been is reaching very rural areas, so my comments have to be taken with that in mind. Naturally, the types of communications can be broken into geographic divisions based on travel time, time-for-response circles, distance, sectors of common interest, etc.

These areas have various internal priorities depending on the content (subject matter) and the variable nature of response time -- is this a hot topic and do we need a response right now or next week. In Alaska we were faced with upwards of four days for someone go travel to attend and all day or half day meeting. Mail would take even longer in reaching a location, perhaps more delays in finding someone that can read the letter to the party, longer to compose the response, and then the time enroute back to the original sender. I think there are a number of examples of very long response times in dealing with South American countries where they spend extreme amounts of time in wording a letter in the most formal dialect. The delays can be frightening to those that are operating on a U.S. business clock. The use of computer conferencing, then may have to go into selected areas where the cultural value programming has not included a deep need to respond in a formalized form. Application in some governmental areas may be difficult from a diffusion of innovation standpoint. In this case application of voice systems with subsequent transcription may be more efficient. Again, it dedepends more on the players than anything else.

Another factor worth considering is the level of typing skills of those that will be using the system. In the U.S. only 5% of the population can type -- a fact that is bothersome to those seeking to implement extensive office automation that includes executives. This assumes, of course, that the executive is neutral in his/her attitude toward the typing process ("typing is only done by secretaries..."). I feel that similar or more severe problems may present themselves in the LCD's.

I ran into one situation where an individual would not touch anything that looked like equipment. The situation seemed to be that in his country machines were operated by uneducated individuals and his Ph.D. placed him in a social circle what negatively reinforced any type of activity that smaked of non-intellectual. Such is the nature of other cultural perspectives. It may be the non-traditional individual that is targeted for computer conference participation.

C1015 CC32 MURRAY TUROFF (MURRAY,103) 10/21/81 11:08 PM L:26
KEYS:/SOME GENERAL COMMENTS/

The first 14 comments in c1071 (which is an inactive conference) may have some interest for some of you. The topic was technology transfer but limited to the porblem in the U.S. There are some good references mentioned.

My experiences with introducing this technology into organizations is that there is nothing academic about it. You look for an application that is going to be a sure winner. Being a sure winner depends as much on the people that are going to be involved as the nature of the application itself. That is what makes the job hard. After the system is in an working well for that inital group and its requirement others will be attracted or gentley shoved into using it. It is that first step that is key. I am afraid the nature of that first step in any underdeveloped country is going to have to be a function of the unique charactoristics of that country. It might be useful to pick a specific case that some of you know a great deal about and just try to figure the best start in that particular country.

I think rural use is possible even in tropical conditions. We may have to go to terminals meeting military specificatons and ham radio equipment to link terminals but if there is a real situation where it can be of significant utility it would be worth it to fund an expierement (not cheap).

In my very early paper on this subject I used the concept of training someone one in a rural region to be a communications specialist--very much like the ship board radio operator. In fact, radio links are used now in some parts of Africa I believe.

In the international area, between countries, I think that the best demonstration would be a multilingual conference between exeprets where the effort was financed well enough to have professional translators and we set up a structure that produced an on going transcript in two or more languages. This has not been done yet and would allow specialists to get involved int he developing contry whos command of the major language used was not up to par with others.

The following comment was received in response to a summary, entered in the conference by IDRC, of a presentation by L. Tarouco on Brazil's experience with computer-based conferencing. Ms. Tarouco's presentation is summarized in that portion of the text dealing with current systems.

C1015 CC39 MURRAY TUROFF (MURRAY,103) 10/28/81 11:32 PM L:23
KEYS:/TARGETS OF OPPORTUNITY BY ALL MEANS/
A: 37

I am very enthused to hear about the Brazil project and would like to get more details on that one if they become avaliable.

I suggest one of the things IDRC can try and facilitate to foster such efforts is to help find the financing for sending promising technical individuals in various countries who might want to follow that model to spend six months or a year at palces like ours or the swedish group to learn about the possibiliteis and the technologies being used. I suggest that these people should be at the working level and not the "big names". I also would recommend that people from the devleoped end be sent for shorter periods the other way. More like a month, because most of the good ones would not have the time to take away from their current efforts to spend longer.

This is at least a low cost start that is not too risky. Problem is identification of groups in the particular devleoping country.

For the Brazil group specifically it would be nice to see them obtain funds for tying into some of the current efforts in the US Sweden and CAnada to develop their awareness and knowledge of what is going on at the technical level.

Anywhere there are technical working groups who are doing a good job with waht is avaliable to them and show an interest in developing into this area a little seed money could go a long way.

C1015 CC43 INT. DEVEL. RES. CENTRE (IDRC,291) 10/29/81 11:15 AM L:10
KEYS:/TECHNOLOGY TRANSFER/

Murray,
I would suggest some slight amendments:

1. Developing countries can benefit through their own trial and error period without benefit of technical advice, and thereby avoid unconsciously adopting inappropriate CC protocols.
2. Maximum encouragement should be given to facilitate assistance by developing countries to other developing countries (the user-consultant analogy of peer assistance could be powerful in this context).

C1015 CC45 MURRAY TUROFF (MURRAY,103) 10/29/81 12:08 PM L:16
KEYS:/COMMENTS/
A: 42

I have seen too many organizations (companies) here in the U.S. try to devleop in house a CC or message system without looking carefully at what had been done elsewhere. In many of these cases they had to scrap what they had done after a few years and start over at the cost of considerable man effort.

I cannot therefore agree with 1. in c43. I am more concerned with the internal design and an understanding of future potential evolultion of the system that must be considered in the initial design.

It would be preferable to consider a super micro for a small system for a number of reasons. A complesystem for a number of reasons. The ballpark for a complete system right now is more like 40,000 rather than 20,000. At the other end the simple bulletin board like micro operation one port at a time can be done for under 10,000 on a standard current generation micro.

C1015 CC47 JACOB PALME (332) 10/30/81 8:52 AM L:23
KEYS:/COM/DEVELOPMENT OF CC/
A: 45

Here is some infrormation about how we developed our COM system which may be of interest in a discussion on how best to develop your own computer conference system.

We began by getting a copy of the FORUM/PLANET system which we used for one year. We also read the EIES specifications and had some practical experience with EIES.

COM was to a large extent developed in FORUM conferences, where a large group of FORUM users took part in the discussions about how to design COM. COM is not a copy of either FORUM/PLANET or EIES, but we learnt the basic ideas from these systems and copied them when we liked them but did things in a different way when we thought we had better ideas.

The extensive experience with FORUM/PLANET was very important to us, COM would not have been as good a system without this experience about advantages, problems, good and bad design points in an existing system.

By the way, we are just in the process of completely rewriting COM from the beginning, making a better system than the initial COM system.

C1015 CC50 ROBERT BEZILLA (ROBERT,213) 10/31/81 7:46 PM L:10
KEYS:/PEOPLE-TO-PEOPLE EXCHANGE/

One topic that really did not come up during the workshop, probably because of lack of time, was the potential of "people-to-people" exchange. Certainly, there are groups in the United States, Canada, and probably in western Europe, who are concerned about appropriate technology and who have found cbcs a useful means to pursue their concerns.

Such groups frequently have very limited resources, and so often have had to adopt strategies to maximize their resources such as they are, to participate effectively in cbcs. I am certain that these experiences could be useful to the developing countries. Eventually, the innovations of the developing countries should be of interest to the groups in the developed (or as some would say "overdeveloped") countries.

Beyond CBCS, of course, exists the potential of establishing people-to-people linkages to discuss other areas of common concern, e.g., appropriate technology in agriculture, energy, etc.

C1015 CC53 RICHARD DALTON (RD,334) 11/ 4/81 12:57 PM L:36

HAVING JUST CAUGHT UP WITH THE COMMENTS IN C1015, I'M IMPRESSED BY THE AMOUNT OF INTEREST AND THOUGHT. YET THERE IS SOME UNCERTAINTY IN MY MIND ABOUT WHETHER TECHNOLOGY OR COMMUNICATION IS THE FOCUS.

PERHAPS BOTH ISSUES NEED TO BE DISCUSSED CONCURRENTLY, SO I'LL JUST THROW OUT SOME THOUGHTS I JOTTED DOWN WHILE READING THROUGH THE COMMENTS:

MURRAY (I THINK) TALKED ABOUT FUNDING FOR PILOT PROJECTS. ONE POSSIBLE SOURCE IS THE "FOUNDATIONS" RUN BY MOST COMPUTER VENDORS (APPLE, H-P, WANG AND

IBM, FOR EXAMPLE) AS THIS EFFORT COULD BE VIEWED BY THEM BOTH AS "HUMANITARIAN" AND AS A POSSIBLE BUSINESS OPPORTUNITY.

USE OF C.C. HAS BEEN SUGGESTED FOR MEDICAL, SEWAGE AND UNIVERSITY ENVIRONMENTS. WHAT ABOUT WEATHER? THIS HAS TURNED OUT TO BE A KEY APPLICATION FOR RURAL INFORMATION SYSTEMS IN THE U.S. AND CANADA AND MIGHT BE AN INTERESTING WAY TO GET PEOPLE INVOLVED -- OFFICIAL WEATHER DATA AMDE AVAILABLE AND COMMENTS FROM PEOPLE 100 MILES NORTH AS TO WHETHER IT'S R E A L L Y RAINING OR NOT. ALSO SUCH INFO AS FREEZE WARNINGS ARE OFTEN CRITICAL TO AN AGRICULTURAL ECONOMY. ONE ADVANTAGE HERE IS THE INTERNATIONAL WEATHER INFO NETWORK (COLLECTED BY NOAA IN THE U.S.) THAT COULD BE TAPPED AS AN DATA BASE.

MUCH HAS BEEN SAID ABOUT LIMITED CASH AVAILABLE FOR EQUIPMENT COMPLICATED BY ADVERSE CLIMATIC CONDITIONS IN MANY LOCALES. WHILE IT MAY SOUND PECULULARLY AMERICAN TO SUGGEST THIS, THE ERA OF "THROW AWAY" HARDWARE IS ALMOST UPON US. RIGHT NOW, $200-30 TERMINALS EXIST WITH A $100 UNIT PROBABLY ONLY A YEAR OR SO AWAY. IN THAT PRICE RANGE, MAYBE DISCARDING A TERMINAL AFTER 6 MONTHS IS PRACTICAL (IF A LITTLE ODIOUS TO THE ECOLOGICALLY-INCLINED). AS A MORE SOPHISTICATED "NODE", A FUNCTIONAL MICRO (SINGLE USER) IS CERTAINLY AVAILABLE RIGHT NOW FOR LESS THAN $1000. ATARI, THE COMMODORE VIC AND RADIO SHACK'S COLOR COMPUTER, FOR EXAMPLE.

FINALLY, THERE HAS BEEN SOME DISCUSSION ABOUT "BEST ANSWERS" WHICH CAN OBSCURE THE TRUISM I HAVE SEEN IN MANY ORGANIZATIONS' PURSUIT OF NEW INFO/COMMUNICATION SYSTEMS IN THE U.S. THAT IS SIMPLY THAT NOTHING EVER SEEMS TO REPLACE ANYTHING. THE BEST NEW THINGS SEEM TO BE THE ONES THAT EFFECTIVELY SUPPLEMENT AND INTEGRATE WITH EXISTING INFORMATION/COMMUNICATIONS RESOURCES.

...RICHARD

C1015 CC54 MURRAY TUROFF (MURRAY,103) 11/ 4/81 7:57 PM L:12
KEYS:/POSTSCRIPT/
A: 53

Yes and No Richard to your last paraghraph! The first application for a group of users should be one they are used to and where the technology offers advantages. That is necessary to get them motivated. After they are 'addicted' it become easier to move out into doing things differently. The latter area is where the higher payoff's usually are because it inolves applications they could not do at all with the current technologies. I think computers in general have followed this pattern interms of the penetration in organizations; however, in the communictions area it is even more cruical to relate first application to an area they already understand well and is relevant to their day to day activities.

C1015 CC56 ELAINE KERR (ELAINE,114) 11/ 6/81 2:42 PM L:17

Having just read this transcript in one sitting, I'm much impressed by its scope and level. It fits into a major value orientation shared by many of us here on EIES in which we want to bring the technology to the disadvantaged, rather than letting it be the exclusive property of the elite. My own surprise and excitement is in the timing, as I never expected to see a serious discussion of these issues this soon.

I see a theme of disagreement in this transcipt which may be of major import: the issue of whether from the vantage of recognizing legitimate cultural differences, the more "advanced" countries maintain their distance, or on the other hand, if they instead benignly "interfere" to share their knowledge. Another way of thinking about this of course is the reinvention of the wheel vs. cumulative learning. I tend to favor a teamwork coopepative sharing approach myself, while recognizing the dangers of cultural encroachment.

Perhaps an acceptable compromise might be using a team of advisors who primarily interacted with their "clients" on the CMCS itself.

Like Murray, I'd like to see these underdeveloped countries construct CMCS systems with built-in evolutionary features. Just as important, I think, is that a program of systematic evaluation be an integral part of these pilot programs.

C1015 CC58 MIRIAM MILLS (CASSIE,960) 11/ 8/81 8:07 PM L:50
KEYS:/THOUGHTS ON IMPLEMENTATION/

Thoughts re CC for underdeveloped countries

1. Providing impetus for Change

Probably one of the more difficult aspects of this problem is the fact that CC is hard to define or describe to those who have not had some familiarity with the process. It may be necessary to find a mode of showing the process without necessarily having individuals

experienced in computer interaction - films have often been used for publicity or propaganda depending on ones bias. One canot always depend on a technology promoting itself. I could envision some demonstration of a problem likely to be of interest to underdeveloped countries and how it was solved or ameliorated by cc. Sound tracks would have to be in different languages.

Another part of this is beginning with a problem rther than with the technology. If certain countries with sufficient development to sustain telephones on a regular basis as well as some basic computer technology could be joined on some small scale project, that could serve as a pilot for other broader scale projects. I am reminded of an exercise in public health in India where there was resistance to the use of milk in liquid form. The alternative here was to use powdered substance with different colors once there was acceptance from the local health officials.

2. Establishing appropriate change agents

the ideal would be to find nationals of various countries who could serve as bridges between the developed and underdeveloped countries. one such example might be a combination of locally trained professionals coupled with professionals who received their education abroad. One has to be cautious not to undermine the local at the expense of the individual more likely to be attuned with the goals of the developed countries. Peter Drucker spoke of the problem of japanese returning to Japan after American training and lacking the "godfather" patron that had served to shield the young japanese getting their education in Japan. A considerable stress on team work of the developed and underdeveloped must be maintained.

3. Recognizing Prestige/perception barriers

An earlier comment referred to the prestige problems of PhDs being reluctant to be seen with what resembled a typewriter (a view similar to that of women who will deny they can type) One needs to establish an acceptable jargon. Although it may seem fanciful, sales rep is more appealing than salesperson, police officer is better than cop and so forth. Some consistency in language will have to be developed so as not to unnecessarily offend those who are culturally unprepared for the gret leveler of the typewriter. Some inventory needs to be taken or research done as to task attitudes within the various countries and adjustments need to be made. For example if "Interactive Communicator" will be acceptable rather than console opertor or heaven forfend, typist, then so be it. Egos are vulnerable and particularly if combined with a basic apprehensiion of being tried and found wanting in a new technology. Granted EIES is forgiving and user responsive, in the same way the protocols and procedures necessary for its implementation need to be equally responsive and forgiving, nay encouraging.

II. Communication Infrastructures

Very little is known about the impact of communication technology. Even less is known about the ways in which the new technology can produce meaningful and wide-ranging socioeconomic benefits. Consequently, in prescribing communication technology for developing countries, considerable skill and caution must be exercised. Not every installation of the latest technology will produce the desired results.

Developing countries are currently looking at the installed communication infrastructures within developed countries and are assuming that these architectures are adequate for their needs of the future. This is not a secure position. By tying themselves to the conventional developed countries' communication infrastructure architectures, developing countries may be incurring a major opportunity cost that will haunt them within the next two decades.

Consider the residential market for communications. The average telephone in such a situation is used two or three times each day and usually accesses only a few dozen different numbers. To install a complete star-configured telephone network to handle this pitifully small amount of traffic, when it could piggyback on other services, may be sheer folly.

Because tomorrow's information society, when it begins to mature, will require facilities that can cope with "broadcast and switched" or "directed" messages with equal overhead costs, the star-shaped configuration is simply not a reasonable architecture in which to invest heavily at this time. Other alternatives are now becoming available.

The situation is clearly ripe to conduct a major feasibility study of a coax- or fibre-based telecommunication infrastructure that would be layered and installed in the following way:

- Conventional cable television broadcast service with several channels available for present and future use.
- "Broadcast VIDEOTEX," like the BBC's CEEFAX. This could use TELIDON standards or PRESTEL. It does not involve any upstream capability.
- With the addition of upstream capability, the larger data base features of "switched VIDEOTEX" can be offered. With only a simple 10-button pad, IIASA has shown that keyword searching can be accomplished. Tree-like data structures need not be the only alternative.
- Messaging from one subscriber to another can now easily be added. With packet technology, the growth of the switching investment can keep pace with the demand, and the switch architecture can match the treelike cable architecture.
- "On demand TV" retrieval can now be supplied and, as this is a premium service, its cost differential could be offset by a corresponding revenue growth.
- Packetized voice services make up the next layer, providing normal telephone-like service. Again, the growth is gentle and matches the distribution medium's structure and the load demand.
- Fully interactive, shared-space audio and VIDEOTEX connections could now be offered. This is probably the most powerful consensus-building service opportunity that can be easily produced. The availability of this service to the business world could produce a major increase in the productivity of business and government.

There is no real necessity to do the things in this specific order. In fact, whole layers could be omitted, if desired.

A feasibility study could be a major IDRC contribution. Such a study should assess the costs, system sizes, timing of availability and demand, and how such systems could successfully evolve into big systems with a large number of customers. This study would have great relevance to both the developed and developing worlds. IIASA could be considered as a resource for such a study.

The study would recognize that existing systems show a high degree of centralist philosophical outlook in their architectures, and that recent developments in technology free us from always having to go this route. The system described would be quite distributed in nature and would be easily expandable. After the original cable investment, new service layers can be added as demand and capital availability dictates.

At present, coax technology provides the best means of carrying the wide bandwidth required by such a system, and because this bandwidth requirement does not contain a stringent group-delay characteristic, coax is quite acceptable. This is a mature technology with many options in the supply area. Fibre, although endowed with a magnificent group-delay characteristic, cannot haul the dirty freight as cheaply or simply. The choice, however, is largely an engineering one and should be made on a life/cost basis. The possibility of a meaningful combination of both should not be overlooked.